U.S. Patent No. 5,036,696 to Ahrens et al. The Applicants traverse this ground for rejection for the following reasons.

The invention disclosed in the Chase patent "relates to the art of papermaking and, more particularly, to the continuous determination of paper strength during manufacture of paper sheet materials." (Col. 1, lines 7-10.) A primary of the Chase invention is "to provide improved systems and methods for continuously determining strength properties of traveling continuous webs of paper sheet material during manufacture on a papermaking machine without destructive testing." (Col. 4, lines 53-57.) More particularly, the object is "to provide improved on-line systems and methods for non-destructively detecting process measurement proxies for strength properties of paper sheet materials during manufacture, which proxies can be used, for example, to control changes in papermaking processes to selectively vary the strength of paper sheet material being produced." (Col. 4, lines 59-65.) The process "is premised upon identification and detection of process measurement proxies or properties for basic physical properties that determine paper strength." (Col. 5, line 65 to col. 6, line 1.) Based upon a characterization of paper sheets as dried mats of fiber, the Chase patent "classifies basic strength properties of paper into two broad categories: properties inherent to fibers, and properties inherent to structural arrangements of fibers." (Col. 6, lines 1-5.) Properties within the first category

include the strength of individual fibers and their length distribution. Properties within the second category include the quantity of fibers, their distribution or "formation", their orientation, the number of bonds between fibers, and the strength of the bonds. These seven strength properties can in turn form the basis for a regression equation representing the strength of a sheet of paper as a function the process measurement proxies for at least four of the seven strength properties. (Col. 15, lines 4-13.) The only example given by Chase is a regression equation for Mullen strength.

The Chase patent neither mentions nor discusses measuring either fracture toughness or proxies that correlate to fracture toughness of paper. Nor does Chase disclose a mathematical model or equation for fracture toughness of paper.

Ahrens et al., on the other hand, discloses a test method for measuring fracture toughness in brittle media, i.e. materials that are predominantly elastic and have no plastic response -- unlike paper and paperboard, which are elastic-plastic film-like materials. The test method and procedure of Ahrens et al. have no bearing on the test method employed in the present invention. Nor does the Ahrens teaching have any relevance to the process for continuous determination of paper strength taught by Chase. More specifically, Ahrens teaches using a gas gun to propel a test projectile into a sample of brittle material. The only brittle material disclosed by

Ahrens et al. are rocks. In particular, in a test performed to demonstrate their claimed invention, samples of Bedford limestone were impacted with a LEXAN projectile carrying an aluminum or PMMA plate accelerated by a 40 mm compressed air gun at controlled velocities of 10-30 m/sec. (Col. 2, lines 46-51.) This is not a test method that would be suitable for testing the fracture toughness of paper.

Thus, neither Chase nor Ahrens et al. disclose or suggest measuring the fracture toughness of paper. Nor does either reference teach the selection of values for material properties that affect the fracture toughness of a paper/paperboard product, as recited in Applicants' independent claim 10. Further, neither reference teaches "storing fracture toughness measurements and associated material property data in a databank" and later manufacturing a grade of paper or paperboard product having material properties substantially equal to those retrieved from the databank, as recited in Applicants' independent claim 17. Also, neither Chase nor Ahrens et al. teaches deriving a mathematical model of fracture toughness of a grade of paper or paperboard as a function of a plurality of material properties of that product, as recited in Applicants' independent claim 19.

As demonstrated above, even if it would have been obvious to combine the teaching of Chase and Ahrens, the result would not be Applicants' invention, since neither reference teaches measuring the fracture toughness of paper.

However, the Applicants vigorously disagree that to combine the teachings of Chase and Ahrens would have been obvious. Chase relates to paper, while Ahrens relates to brittle media such as rocks. Since they relate to testing the strength of two different classes of materials, the Applicants submit that Chase and Ahrens constitute non-analogous prior art and are not obviously combinable.

For all of the foregoing reasons, the Applicants submit that the rejection of claims 10, 11, 13-15, 17, 19, 20 and 23 as being obvious over Chase in view of Ahrens et al. is unsustainable and should be withdrawn.

The examiner has also rejected claims 12, 16, 18, 21 and 24 as being obvious over Chase in view of Ahrens et al., and further in view of U.S. Patent No. 3,490,689 to Hart et al. The Applicants traverse this ground for rejection for the following reasons.

The Hart et al. reference discloses the control of a machine system, e.g., papermaking, via a combination of sensors. The examiner cites Hart for teaching "automatic control of a paper machine" and for teaching the addition of a filler, namely, alum, to the mixing chest. The examiner asserts: "It would have been obvious to the routineer that alum (filler) could have been one of the additives measured by CHASE '403 in the manner taught by HART." The Applicants disagree.

In the first place, the examiner has failed to cite to any portion of the Hart patent where it states that the alum level is measured. Column 7, line 71 merely states that "alum may be supplied to the mixing chest."

Secondly, the examiner's proposed combination of Hart with Chase would not be obvious. The Chase patent clearly shows in Figure 7 the properties to be measured under the column labeled MEASUREMENT. The measurement of the level of filler does not appear as one of the measurements to be taken. That circumstance is probably due to the fact that Chase is interested in only two categories of paper strength properties: (1) properties inherent in fibers and (2) properties inherent to structural arrangements of fibers. Thus, Chase would have no motivation to measure the level of filler since nothing in Chase indicates that filler level impacts the strength properties of interest to Chase. Consequently, it would not have been obvious at the time of Applicant's invention to import filler measurement from Hart into the teaching of Chase.

Third, with respect to rejected claims 16 and 24, the Applicants respectfully point out that the examiner has cited no prior art reference showing a mathematical model for the fracture toughness of paper. Such a formula is recited in rejected claims 16 and 24. The examiner does not assert that this formula or anything similar is disclosed in Chase, Hart or any other reference. In fact, there is nothing obvious

about Applicant's mathematical model. Since the citation of Hart for the teaching of the addition of filler to a mixing chest is completely irrelevant to the mathematical model recited in claims 16 and 24, and since the examiner has articulated no comprehensible ground for rejecting those claims, the rejection of claims 16 and 24 as being obvious over Chase in view of Ahrens and Hart should be withdrawn.

Finally, in the action the examiner rejected claim 22 as being obvious over Chase in view of Ahrens et al., and further in view of the article by Page et al. The Applicants traverse this ground for rejection for the following reasons.

Claim 22 depends from claim 20, which in turn depends from claim 19. As already argued, claim 19 is patentable over the combination of Chase and Ahrens et al. because neither reference discloses or suggests deriving a mathematical model of fracture toughness of a grade of paper or paperboard as a function of a plurality of material properties of that product. Nor does the Page et al. article contain such a teaching. Moreover, claim 22 is patentable over the combination of Chase, Ahrens and Page at least for the same reasons that claim 19 is patentable over such combination.

In summary, Applicants' patent application is clearly directed toward the development of a new paper-based product whose mechanical functionality is greatly improved. Throughout the application the Applicants detail how to prove

that this functionality is improved using a non-classical method of evaluation (fracture toughness), which sheds light on the sheet's energy-absorbing capacity.

The Applicants also disclose what factors (fiber furnish, filler, etc.) need to be taken into account for creating the new, improved product, and have presented a mathematical model that governs performance predictions, in terms of fracture toughness, as a function of basic papermaking variables (fiber furnish, filler, etc.).

The Applicants submit that it was not obvious to a person skilled in the art what the mathematic model for fracture toughness of paper would be. In fact, the Applicants included voluminous experimental data (see the tables in the Appendices) from numerous experiments that were conducted. Only after extensive data acquisition were the Applicants able to derive the rigorous structure-property-performance mathematical relationship disclosed in claimed in the instant application. This empirically derived mathematical model is in no way obvious from the prior art cited by the examiner. In contrast to Applicants methods for developing a paper product with improved performance, the cited patents develop methods for testing varying materials. Furthermore, Applicants' measurement/evaluation techniques are different from those enunciated in the aforementioned patents or journal publication. And, no one can logically conclude that from the ability to measure a physical property, it "becomes obvious"

to make a new product: The two are neither dependent on each other, nor mutually exclusive.

In view of the foregoing, the Applicants submit that all pending claims are in condition for allowance. Reconsideration of the application and allowance of claims 10-24 are hereby requested.